

CLAIMS

1. A method of determining a property of a desired region in an object, the method comprising:
- 5 transmitting first and second energy beams from first and second sources into the object such that the beams intersect at the desired region to induce vibration of the desired region;
- transmitting energy from a third source into the desired region;
- receiving signals from the desired region due to the energy from the third source;
- 10 and
- analyzing at least one of amplitude, phase and frequency of the vibration of the desired region indicated by the received signals to determine the property of the desired region.
- 15 2. The method of claim 1 wherein the analyzing comprises analyzing the amplitude of the vibration and at least one of the frequency and the phase of the vibration.
3. The method of claim 2 wherein the first and second energy beams have first and second frequencies, respectively, that are different from each other.
- 20 4. The method of claim 2 wherein the analyzing determines a value related to a mechanical property of the desired region or a parameter that is related to the mechanical property of the desired region.
- 25 5. The method of claim 4 wherein the value is related to a stiffness/elasticity of the desired region.

6. The method of claim 2 wherein the analyzing comprises cross-correlating multiple received signals.

7. The method of claim 6 wherein the energy from the sources is ultrasound energy and the energy from the third source is one of a plurality of ultrasound pulses and a plurality of ultrasound bursts.

8. A system for determining a property of a desired region in an object, the system comprising:

10 first, second, and third transducers configured to convert electrical signals into ultrasound energy and to transmit the ultrasound energy to the desired region;

at least one frequency generator coupled to the first and second transducers and configured to supply electrical signals to the first and second transducers;

15 a transmitter/receiver coupled to the third transducer and configured to provide pulse signals to the third transducer and to receive pulse echo signals from the third transducer; and

a processor coupled to the transmitter/receiver and configured to analyze the pulse echo signals to determine at least one of amplitude, phase and frequency of vibration induced in the desired region by ultrasound energy transmitted by the first and second transducers, and to use the at least one of amplitude and frequency of the vibration to
20 determine the property of the desired region.

9. The system of claim 8 wherein the processor is configured to analyze the amplitude of the vibration and at least one of the frequency and the phase of the vibration.

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10. The system of claim 9 wherein the at least one frequency generator is configured to provide the electrical signals to the first and second transducers with first and second frequencies, respectively, that are different from each other.

11. The system of claim 9 wherein the processor is configured to determine a value related to a mechanical property of the desired region.

5 12. The system of claim 9 wherein the value is proportional to a stiffness/elasticity of the desired region.

13. The system of claim 9 wherein the processor is configured to cross-correlate multiple received pulse echo signals.

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14. A system of determining elasticity of a desired region in an object, the system comprising:

first and second ultrasound transducers configured to convert electrical signals into ultrasound energy and to transmit the ultrasound energy to the desired region;

15 first and second frequency generators coupled to the first and second ultrasound transducers, respectively, and configured to provide the first and second ultrasound transducers, respectively, with first and second signals configured to cause the first and second ultrasound transducers to emit ultrasound energy having first and second frequencies, respectively, that are different; and

20 determining means for providing energy to, and receiving energy from, the desired region and determining the elasticity of the desired region, based on the received energy, in a manner that is substantially independent of portions of the object disposed between the desired region and the system.

25 15. The system of claim 14 wherein the determining means is configured to provide ultrasound pulses to the desired region, to detect echoes of the pulses, and to analyze the echoes of the pulses to determine at least one of amplitude and frequency of vibration induced in the desired region by the ultrasound energy transmitted by the first

and second transducers.

16. The system of claim 15 wherein the determining means is configured to determine both the frequency and the amplitude of the vibration.

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17. The system of claim 16 wherein the determining means is configured to cross-correlate multiple received echoes.

18. The system of claim 17 wherein the determining means comprises a third
10 ultrasound transducer and wherein the first, second, and third ultrasound transducers are portions of a phased array of transducers.

19. The system of claim 18 wherein the first, second, and third ultrasound transducers each comprise a plurality of transducers.

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20. The system of claim 18 wherein the first, second, and third transducers are part of one phased array and the third transducer is driven to produce an ultrasound beam with a frequency of about an odd harmonic frequency produced by other portions of the array.